



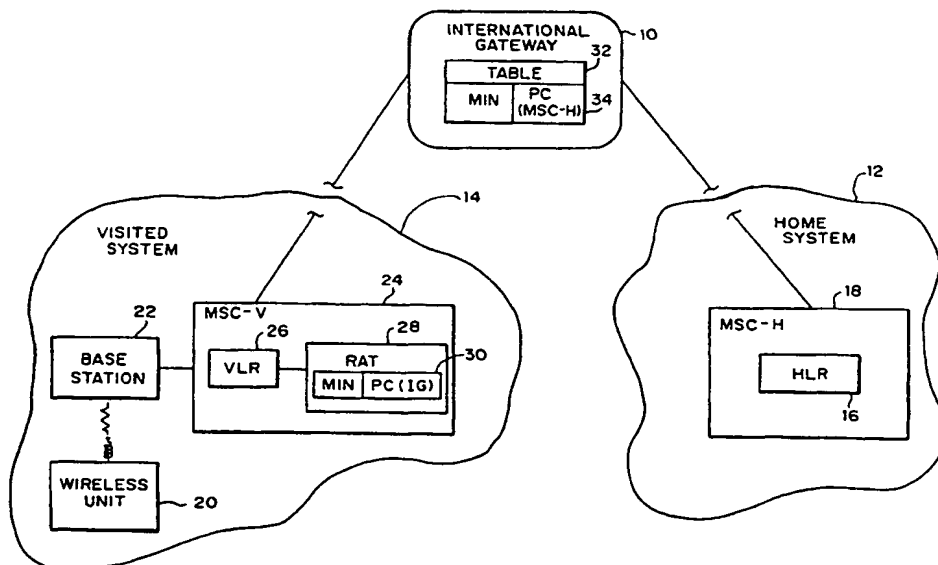
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(54) Title: METHOD AND SYSTEMS FOR PROVIDING INFORMATION TO A HOME SYSTEM REGARDING A WIRELESS UNIT ROAMING IN A VISITED SYSTEM

## (57) Abstract

Methods and systems to provide a home system with information about a wireless unit roaming in a visited system based on information the wireless unit provides to the visited system. A mobile switching center (MSC-V) of the visited system receives the information from the wireless unit and routes a message to an international gateway. In response, the international gateway creates a new message or alters the original message, and transmits the new or altered message to a mobile switching center (MSC-H) of the home system. In response to receipt of the new or altered message, the MSC-H validates the wireless unit (if valid), creates a response to the new or altered message, and routes the response to the international gateway. The response may include an authorization period for the wireless unit and/or OCOS/TCOS information. In response, the international gateway creates a new response or alters the response, and transmits the new or altered response to the MSC-V. In response to receipt of the new or altered response, the MSC-V registers the wireless unit, provides the wireless unit with communication services in the visited system, or otherwise follows instructions in the new or altered response. If the wireless unit moves to an area served by a second MSC-V, the second MSC-V checks with the international gateway about the wireless unit. If an authorization period is in effect, the international gateway may provide a validation of the wireless unit to the second MSC-V without another message to the home system of the wireless unit.



METHOD AND SYSTEMS FOR PROVIDING INFORMATION  
TO A HOME SYSTEM REGARDING A WIRELESS UNIT  
ROAMING IN A VISITED SYSTEM

5 RELATED APPLICATION

The present application claims priority to and the benefit of the prior filed  
copending and commonly owned provisional application entitled "SCP/International  
Gateway -- An SS7 Network Element That Performs SS7 Message Routing, Call Delivery  
and PIN Fraud Protection for Cellular Users Roaming Internationally," filed in the United  
10 States Patent and Trademark Office on November 5, 1998, assigned Application No.  
60/107.224, and incorporated herein by reference.

TECHNICAL FIELD

This invention relates to telecommunications, and in particular, to the provision of  
15 information to a home wireless communications system with respect to a wireless unit  
that is roaming in a visited wireless communications system.

BACKGROUND OF THE INVENTION

A distinguishing feature of humans as a species is our ability to communicate with  
20 each other. Our methods of communication have become ever more sophisticated and  
have led to the development of wireless communications. Generally, wireless  
communications are communications that are transmitted through the use of radio  
frequency (RF) technology. Wireless communications include communications that are  
transmitted through the use of wireless units such as cellular telephones, mobile  
25 telephones, car phones, personal communication service (PCS) units, pagers, and the like,  
and also may include appropriately equipped computers, computer peripherals, and the  
like.

A wireless unit is particularly useful to a person on the move. For example, a  
person may use his or her wireless unit while driving a car. The wireless communications  
30 service to the person's wireless unit is provided typically by a service provider that may

other networks, and/or wireless communications systems until the communication reaches the MSC serving the subscriber's wireless unit. This MSC may be referred to as the serving MSC or the serving switch. The serving MSC then further routes the communication to the wireless unit.

5 As noted, a wireless unit is particularly useful when a subscriber is on the move such as when the subscriber is driving a car. The subscriber's mobility may take the subscriber out of the service area served by the service provider from whom the subscriber subscribes. In other words, the subscriber's mobility may take the subscriber out of his or her home service area served by his or her home service provider or home  
10 carrier. The subscriber may move so as to be located in another service area that is served by a different service provider with whom the subscriber has no direct business relationship. The subscriber is said to be "roaming" out of his or her home service area and may be referred to as a "roamer", or "roaming subscriber" in a visited service area that is served by a visited system. To provide a roaming subscriber with communications  
15 service, service providers have agreed to follow certain procedures in the processing of communications with respect to each other's subscribers. Generally, a roaming subscriber is validated and may be authenticated by the visited system, which also may be referred to as the visited service provider. Both of these processes (validation and authentication) are used to prevent fraudulent use of wireless units and for other reasons. General  
20 descriptions of these processes and other information about wireless communications systems may be found in the book entitled Cellular and PCS - The Big Picture by Lawrence Harte, Steve Prokup and Richard Levine (McGraw-Hill 1997).

Generally, in validation, when a wireless unit initiates a communication in a service area other than its home service area, the visited system serving that visited  
25 service area attempts to find the wireless unit's identification (also referred to as registration information) in the visitor location register (VLR) of an appropriate MSC in the visited system (MSC-V). If the visited system does not find the identification, then the wireless unit is determined to be not registered with the visited system. Prior to being provided with communications service in the visited system, a wireless unit typically  
30 needs to be registered in the visited system.

respect to the wireless unit. If so, the MSC-H sends a request to the visited MSC (MSC-V) for information that will help the MSC-H in routing the call to the subscriber.

The above processes of validation and call processing are carried out generally with respect to communications that occur within the United States. However, wireless communications between the United States and foreign countries or wireless communications between foreign countries have been problematic. Problems arise because the processes described above may not be carried out with respect to communications between the United States and a foreign country or between foreign countries because of the differences in the wireless systems in the respective countries. A wireless system and its related wireline system in a particular country may not be networked with the wireless system and its related wireline system in a foreign country. Thus, in some cases, information regarding a wireless unit's roaming location in a visited system is not reported properly to the home system. The lack of reporting is especially problematic between countries having differences between their respective wireless systems. Without location information regarding a wireless unit, the home system is unable to route calls to the wireless unit.

In addition, the problems associated with the fraudulent use of wireless units are prevalent in the United States and abroad. Once a wireless unit is registered in a visited system, the wireless unit may be especially vulnerable to being cloned or otherwise fraudulently used.

Accordingly, there is a need for methods and systems that provide location information regarding a wireless unit that is roaming in a visited system to a home system of the wireless unit. Further, there is a need for methods and systems that provides safeguards so as to prevent fraudulent use of wireless units as they roam between and among countries or systems.

## SUMMARY

The present invention includes methods, systems, and apparatus that relate to the provision of information to a home wireless communications system regarding a wireless unit that is roaming in a visited wireless communications system. This information may include an identification of the serving mobile switching center (MSC) serving the

response to receipt of the new or altered response, the MSC-V may register the wireless unit, and/or provide the wireless unit with communication services in the visited system, and/or otherwise follows instructions in the new or altered response.

Further, an exemplary embodiment of the present invention advantageously eliminates the need for an exchange of message and response with the home system when the wireless unit moves from a first visited system to a second visited system during an authorization period. For example, the wireless unit may be provided with communications services in a first visited system during an authorization period. The wireless unit may move to a second visited system during the authorization period. The serving MSC in the second visited system checks with the international gateway, which in turn, checks whether the authorization period with respect to the wireless unit has expired. If it has not expired, then the international gateway provides the serving MSC in the second visited system with a validation relating to the wireless unit. The second visited system provides the wireless unit with communications services at least for the remainder of the authorization. It is an advantage that the communications service is continued to the wireless unit in the second visited system without the second visited system having to check with the home system of the wireless unit.

Advantageously, the use of an international gateway in the exchange of messages between the MSC-V of the visited system and the MSC-H of the home system facilitates the exchange of the messages between the appropriate mobile switching centers.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram illustrating use of an exemplary international gateway in an exemplary environment.

Fig. 2 is a flow diagram illustrating an exemplary method of the present invention.

Fig. 3 is a block diagram illustrating an exemplary international gateway.

Fig. 4 is a diagram of logical software entities in an exemplary international gateway.

Fig. 5 is a diagram of the message/response exchange handled by an exemplary international gateway with respect to the second registration of a wireless unit within an authorization period.

incorporated in or as part of another device such as an intelligent peripheral (IP) in a wireless communications system, or in other devices. As a result of the functions the international gateway carries out, the international gateway also may be referred to herein as a personal identification (PIN) validation platform. Moreover, the international gateway may be considered to be a series of functions that may be carried out in a single device or that may be carried out through the use of several devices. In the exemplary embodiments described below, generally the international gateway functions in accordance with Signaling System 7 (SS7) protocols as well as EIA/TIA IS-41 protocols, and thus, may be accessed through the connectivity between and among network elements of wireless communications systems and/or wireline communications systems including the public switched telephone network (PSTN). Further, the international gateway may be connected to customer service elements of the service provider of the international gateway, and even may be accessed (or partially) accessed by customers of the service provider of the international gateway through the Internet or other communications networks. Generally, customers of the service provider of the international gateway include carriers who provide wireless service to subscribers and who desire to facilitate the provision of wireless service to such subscribers when they are roaming, and particularly, roaming in foreign countries or systems.

Fig. 1 - An Exemplary International Gateway

Fig. 1 is a block diagram illustrating use of an exemplary international gateway 10 in an exemplary environment including a home system 12 and a visited system 14. The home system 12 generally is a wireless communications system provided by a service provider with whom a subscriber has a relationship such that a wireless unit used by the subscriber typically is registered in a home location register (HLR) 16 of a mobile switching center (MSC-H) 18 when the wireless unit is located in the geographic area served by the MSC-H 18. A communication from a caller and directed to the mobile number of the wireless unit is routed to the MSC-H 18 for further routing to the called wireless unit.

Fig. 1 also illustrates a visited system 14 including a wireless unit 20 that is roaming or visiting in the visited system 14. When the wireless unit 20 is turned on,

results from a relationship established and based on the roamer's subscription for wireless service from a service provider that is a customer or otherwise affiliated with the international gateway 10 or provider of international gateway services. Thus, the RAT table 28 in the MSC-V 24 may be set up with the point code of the international gateway 10 associated with the visiting subscriber's MIN range in the VLR 26 of the MSC-V 24.

Based on this association between the MIN for the wireless unit 20 and the point code for the international gateway 10, the MSC-V creates a registration message, such as a registration notification (REGNOT) message. The MSC-V 24 uses the point code for the international gateway 10 as a destination point code in the registration message so as to route the message to the international gateway 10. The subsystem number (SSN) of the international gateway 10 also may be included in the message. Typically, the MSC-V 24 sends the message to a routing element such as a service transfer point (STP) in the wireless communications system of country B. The registration message generally contains a mobile identification number (MIN), electronic serial number (ESN), system identification (SID), mobile switching center identification (MSCID), destination point code (DPC), originating point code (OPC), primary interexchange carrier (PIC code, authorization period, and may include other information.

The following table I provides invoke parameters relating to an exemplary registration message such as a registration notification message:

32 for the MIN of the wireless unit 20. The entry 34 may provide the international gateway 10 with an association between the MIN for the wireless unit 20 and a point code for the MSC-H 18 in the home system 12 of the wireless unit 20. Based on this association between the MIN for the wireless unit 20 and the point code for MSC-H 18, 5 the international gateway 10 creates a new registration message. The new message typically is another Registration Notification (REGNOT) message. The new registration message includes the point code for MSC-H 18 as a destination point code so as to route the new message to the MSC-H 18. As an alternative to the use of the table 32, the information for use of the point code for the MSC-H 18 may be obtained in other 10 manners, such as from other tables, from the information in the REGNOT message, or otherwise so that the new message is routed to the MSC-H 18 of the roamer.

The new registration message does not have to be a "new" message such as a freshly created message. Rather, the registration message received from the MSC-V 24 may be translated or altered by the international gateway 10 to create the new registration 15 message. For example, the destination point code in the message may be changed from the point code of the international gateway 10 to the point code of the MSC-H 18. Referring to the invoke parameters listed above in Table I, the international gateway 10 preferably changes the PC\_SSN field to correspond to the MSC-H 18. In addition, the originating point code in the registration message may be changed from the point code for 20 the MSC-V 24 to the point code for the international gateway 10 in the new registration message.

Advantageously, the international gateway 10 includes an identification of the MSC-V 24 in the new registration message. Some clearing houses or other entities that pass information between a visited system and a home system fail to include identification 25 of the visited system, and particularly, of the MSC serving the roaming wireless unit in the visited system in messages that are passed to the home system. This failure can be understood from the way messages are typically configured. For example, a clearing house may be sent a registration message from an MSC in a visited system. The originating point code in this registration message is the point code of the MSC in the 30 visited system. When the clearing house forwards the message to the home system, the clearing house substitutes its own point code for the originating point code in the



home system may make use of this identification to provide service or to correct service deficiencies to the roaming wireless unit. The home system also may make use of this identification to carry out traffic, use, and/or other pattern studies.

After creation of the new registration message, the international gateway 10 routes the message to the MSC-H 18 of the wireless unit 20.

Referring still to Fig. 2, in block 58, the MSC-H 18 receives the new registration message. In response, the MSC-H 18 checks out the new message with respect to the wireless unit 20, and may store the new message or pertinent information therefrom. Advantageously, the MSC-H 18 may log or store the new message or pertinent information therefrom to retain information about the location of the wireless unit 20 so the MSC-H 18 may use the information to route calls to the roamer 20, to resolve service issues, and/or to carry out traffic, use, or other pattern studies.

In block 60, the MSC-H 18 checks out the new message with respect to the wireless unit 20 by checking whether the wireless unit 20 is valid. If the wireless unit 20 is invalid, then in block 62, the MSC-H 18 creates a response to the new message including a denial of roaming. On the other hand, if the wireless unit 20 is valid, then in block 64, the MSC-H 18 creates a response to the new message including allowance of roaming. Generally, the response includes the point code of the MSC-H 18 as the originating point code and the point code of the international gateway 10 as the destination point code. The response generally is a RegistrationNotificationReturn message.

The following table II provides result parameters relating to an exemplary response:

Table II

SystemMyTypeCode	Vendor of the MSC-H
AuthorizationDenied	If set, the international gateway will log this transaction as a fraud detection by the MSC-H
AuthorizationPeriod	3 = Validation and profile
OriginationIndicator	Will be overridden by international gateway
Digits	Destination
TerminationRestrictionCode	Will be overridden by international gateway

the OCOS/TCOS information or override any incorrect OCOS/TCOS information in the response so that the wireless unit will be denied originating service. The international gateway 10 may add to or override the OriginationIndicator and/or the TerminationRestriction Indicator fields so that the wireless unit is will be provided only  
5 terminating service.

Another anti-fraud feature that may be initiated in connection with the response that is created by the MSC-H 18 in response to the new registration message relates to an authorization period for communication services to be provided to the wireless unit in the visited system. In particular, the response may include an instruction to the MSC-V 24  
10 with respect to an authorization period. For example, in high fraud areas, a wireless unit 20 may be registered with an MSC-V 24 only for a limited amount of time (i.e., an authorization period), and thus, the wireless unit 20 may receive communications services only for that limited amount of time. This limitation may minimize the possibility the wireless unit 20 may be fraudulently used. In the previous example, the MSC-V 24  
15 receives the authorization period and keeps track of the start and stop of the authorization period with respect to the wireless unit 20. But instead of the MSC-V 24 keeping track, the international gateway 10 may keep track of the authorization period with respect to the wireless unit 20. When the authorization period has expired, the international gateway 10 may send an MSInactive (Invoke Last) message to the MSC-V 24.

20 Referring again to Fig. 2, after either block 62 or 64, in block 66 the MSC-H 18 routes the response to the international gateway 10 by using the point code of the MSC-H for the originating point code and by using the point code of the international gateway 10 for the destination point code.

In block 68, the international gateway 10 receives the response from the MSC-H  
25 18, creates a new response, and routes the new response to the MSC-V 24. In addition, the international gateway 10 may store the response or pertinent information from the response. The international gateway 10 stores the OCOS/TCOS information that is received in the response because such information may be used later, such as in a QualificationDirective message. Generally, the new response includes the point code of  
30 the international gateway 10 as the originating point code and the point code (and possibly the system serial number (SSN)) of the MSC-V 24 as the destination point code.

20 with communication service only for a limited time, or may only maintain the registration of the wireless unit 20 in its VLR 26 for a limited time.

If the new response includes OCOS/TCOS information, then the MSC-V 24 may provide the wireless unit 20 with communication services in the visited system 14 based on the OCOS/TCOS information. For example, the OCOS/TCOS information may alert the MSC-V 24 that the wireless unit 20 is only to receive terminating service. In other words, the wireless unit 20 may receive communications, but may not initiate communications. The limitation of communication service to a wireless unit 20 based on OCOS/TCOS information is a fraud control measure and advantage of exemplary embodiments of the present invention. Statistically, most fraudulent uses of a wireless unit 20 are associated with calls made from a unit, i.e., in originating service, rather than in calls made to a unit. Thus, a limitation on communication service to only terminating service to a wireless unit 20 may reduce fraudulent use of the wireless unit 20. The process ends in block 72

### Fig. 3 - An Exemplary International Gateway

Fig. 3 illustrates elements of an exemplary international gateway 10 such as may be used in the exchange of messages and responses between a visited system and a home system. The international gateway 10 generally includes an interface 73 and a translator 74. The interface 73 functions as a connection to the communications systems (and elements thereof) which the international gateway serves. An exemplary international gateway 10 has an interface 73 that includes SS7 links 75 that receive the messages and responses, and that pass the messages and responses to an SS7 stack 76. The SS7 stack 76 discriminates and passes the messages and responses to an IS-41 message handler such as provided by the IntelliSS7-IS41 MAP 77, which is a mapping software. In particular, the SS7 stack 76 passes the data of the IS-41 messages and responses to a parsing library where the message is decoded according to IS-41 standards. In the parsing library, the message type, components, and parameters are located in the received messages and responses and stored, (or a pointer stored) in structures which can be then accessed directly. Once the messages and responses are parsed, the data then is passed to the translator 74 carrying out the appropriate operations.

components of the international gateway 10 communicate among themselves and other data networks via TCP/IP connections. The connectivity preferably supports T1/E1 and V.35 at speeds of up to 64 Kbps. It is further preferred that the international gateway 10 generally does not use the Global Title Translation (GTT) in addressing entities or elements in the systems.

#### Information With Respect to the International Gateway

The international gateway 10 is set up and continually updated with current information as to users, customers, MSC information, etc. so as to facilitate the exchange of messages and responses between a visited system and a home system of a wireless unit. Generally, the international gateway 10 operates pursuant to IS-41 specifications. For example, the international gateway 10 starts a timer to time the interval between routing a new message and receiving a response to the new message. If appropriate, the international gateway 10 handles a timeout on the response. The international gateway 10 responds with error messages in the appropriate situations. For example, the international gateway 10 responds with a Return Error with an error code of OperationNotSupported if the international gateway 10 receives a message for call delivery to a wireless unit that has not registered, that is outside its authorization period, etc. Error codes may include SystemFailure, ParameterError, UnrecognizedParameterValue: MIN/HLRMismatch, UnrecognizedESN, Operation Sequence Problem, and/or ResourceShortage.

The international gateway 10 may include the table 32 and/or database 80 as well as other memory or storage facilities with respect to the information that is necessary or available with respect to operation of the international gateway 10.

#### User or Subscriber Information

The table 32 or database 80 may include entries or records related to users. Each entry or record may include the following information or a field (which may be empty until filled) for the following information with respect to the user or the wireless unit of the user: a mobile identification number (MIN); an electronic serial number (ESN); a user or subscriber name; a personal identification number (PIN); a date-time of last PIN change; a number of retries for PIN change in current interval; an MSC-H; a current MSC-V; a previous MSC-V; a date-time of last successful PIN validation; a number of

international gateway 10 may include audit trails for all changes made to the database, such as changing a PIN, etc. These audit trails may be recorded and stored.

#### MSC Information

To facilitate the exchange of messages and responses, the international gateway 10 may store information such as attributes with respect to mobile switching centers (MSCs) which are involved in transactions related to a wireless unit. These attributes may include: an MSC identification; a location; a point code; a subsystem number (SSN); an HLR identification (null if co-located with the MSC); an HLR point code; an HLR SSN; a VLR identification (null if co-located with the MSC); a VLR point code; a VLR subsystem number (SSN); an authentication center (AC) identification; an AC point code; and/or an AC SSN. This information may be stored in the database 80 or in some other memory structure. An exemplary embodiment of the international gateway 80 stores this information in a functional entity messaging relationship table (FEMR table).

#### Home-Visited Relationship

The international gateway 10 may include a table or other structure that sets forth a relationship including operating or override values between mobile switching centers (MSCs) in a home-visited relationship. This table may be used by the international gateway 10 to override values that are present in the user or subscriber entry or record when appropriate. For example, the visited MSC may be located in a high fraud area. In that case, an authorization period with respect to the registration or provision of communications service to a wireless unit may be instituted through the provision of instructions from the MSC-H or the international gateway to the MSC-V or otherwise. Thus, this table may include the following attributes, information or fields: MSC-H identification; MSC-V identification; authorization period; and/or authorization value.

#### MSC-NPA Information

The international gateway 10 may have to determine the MSC-H of a particular wireless unit based on the information that is provided to the international gateway 10 by the MSC-V. Typically, the international gateway 10 uses the MIN of the wireless unit to find the MSC-H (and its point code) by using an MSC-NPA information table. Particularly, the MIN may be compared to the entries of NPA-NXX-x blocks that are

international gateway 10 to a separate entity for further processing (billing, debugging, network problems, etc.). IS-41 API & Vendor's SS7 102 stack is an IS-41 API built on top of the SS7 stack. The SS7 stack functionality is handled within separate processes, i.e., they are not libraries. The IS-41 API is incorporated in these separate processes.

5 DIR 104 is a platform configuration task called the Director. It provides a command line interface for configuring the SS7 stack and all network parameters associated with setting up the international gateway 10 as a functional network entity. The DIR 104 also can be used to control the SS7 stack processes.

10 Fig. 5 - A Second Registration Within An Authorization Period

A wireless unit 20 may be registered with a visited system 14 pursuant to the exemplary method illustrated in Fig. 2. Pursuant to that exemplary method, the wireless unit 20 may be assigned an authorization period with respect to its registration in the visited system 14 or with respect to communication services to be provided to the wireless

15 unit in the visited system 14. Given the mobility of users, the wireless unit 20 may be moved from the area served by the MSC-V 24 in the visited system 14 to a different area served by another MSC ("new MSC-V" or "second MSC-V") in the visited system 14 or in another visited system ("second visited system"). The move may occur within the authorization period initially assigned to the wireless unit 20. Advantageously, the

20 present invention includes embodiments whereby the international gateway 10 provides the new MSC-V with a response that indicates the wireless unit 20 is valid with respect to registration or the provision of services. The international gateway 10 facilitates this validation by handling the response to the new MSC-V rather than exchanging a message and response with the MSC-H 18 of the home system 12.

25 Fig. 5 is a diagram of the message and response exchange between the international gateway 10 and the new MSC-V 106 in the visited system 14 with respect to the second registration of the wireless unit 20 within an authorization period. The wireless unit 20 (also referred to as "mobile") has moved to a different MSC area (i.e., the area served by the new MSC-V 76).

30 As illustrated by arrow A, the wireless unit 20 transmits information such as registration information (Mobil Regn) to the new MSC-V 106. In response to receiving

Based on the determination that this is a second registration within an authorization period, the international gateway 10 creates a response to the registration notification message. The response generally is a RegistrationNotificationReturn (regnot) message.

5 As indicated by arrow D, the international gateway 10 routes the response by way of the appropriate STP (such as illustrated Chile STP 108), which in turn, as indicated by arrow E, routes the response to the new MSC-V 106. The response may include OCOS/TCOS information or instructions with respect to an authorization period. The new MSC-V 106 receives the response, and if appropriate, updates its VLR by registering  
10 the wireless unit 20 in its VLR. The new MSC-V 106 also may update its VLR or other databases with respect to the other information related to the wireless unit 20 such as the OCOS/TCOS information or the authorization period. In response to receiving the response, the new MSC-V 106 may provide the wireless unit 20 with communication services in the visited system 14. Alternatively, in response to receiving the response, the  
15 new MSC-V 106 simply may register the wireless unit 20 in its VLR. With respect to the provision of communication services or the registration of the wireless unit 20, the new MSC-V also may implement an authorization period if the new MSC-V 106 has received such instructions. In other words, the new MSC-V 106 may provide the wireless unit 20 with communication service only for a limited time, or may only maintain the registration  
20 of the wireless unit 20 in its VLR for a limited time. Yet another alternative is that the new MSC-V 106 may receive OCOS/TCOS information in the response from the international gateway 10. If so, then the new MSC-V 106 may provide the wireless unit 20 with communications services based on the OCOS/TCOS information. For example, assume the response includes OCOS/TCOS information such that the new MSC-V 106 is  
25 to provide the wireless unit with terminating service only as the communication services to be provided to the wireless unit. In that case, the new MSC-V follows through and provides the wireless unit only with terminating service. If an authorization period also is included in the response, then the new MSC-V may provide the wireless unit with terminating service only and only for the authorization period.

30 Still referring to Fig. 5, also as a result of receiving a second registration message with respect to the wireless unit 20 within an authorization period, the international

From the foregoing description of the exemplary embodiments and the several alternatives, other alternative constructions of the present invention may suggest themselves to those skilled in the art. Therefore, the scope of the present invention is to be limited only to the claims below and the equivalents thereof.



3. The method of Claim 1, wherein the response comprises originating and/or terminating service (OCOS/TCOS) information;

wherein the new response comprises the OCOS/TCOS information; and

5 wherein the MSC-V is caused to provide the wireless unit with the communication services in the visited system based on the OCOS/TCOS information.

4. The method of Claim 3, wherein the OCOS/TCOS information comprises an instruction to provide terminating services only; and

10 wherein the MSC-V is caused to provide the wireless unit with the terminating services only as the communication services in the visited system based on the OCOS/TCOS information.

5. The method of Claim 1, wherein the MSC-V is caused to provide the wireless  
15 unit with the communication services in the visited system for an authorization period.

6. The method of Claim 5, wherein the MSC-V comprises a first MSC-V, and wherein the wireless unit moves to an area served by a second MSC-V, further comprising:

20 F. receiving at the second MSC-V second registration information from the wireless unit;

G. in response to receiving the second registration information, causing the second MSC-V to reroute a second registration to the international gateway;

25 H. in response to receiving the second registration, causing the international gateway to make a determination that the authorization period is in effect; and

I. in response to the determination, causing the international gateway to send a validation with respect to the wireless unit to the second MSC-V.

10. The international gateway of Claim 8, wherein the OCOS/TCOS information comprises an instruction to provide terminating services only.

11. The international gateway of Claim 8, wherein the visited system comprises a  
5 first visited system;

wherein the wireless unit moves to an area served by a second visited system; and

wherein the interface is also operative to receive a second registration message from the second visited system;

10 wherein the translator comprises storage, and the translator is operative to use the registration message to check the storage to make a determination that an authorization period assigned to the wireless unit for provision of the communication services to the wireless unit is in effect; and

15 wherein the translator also is operative to send a validation of the wireless unit to the second visited system.

12. A system to provide a home system with information about a wireless unit that is roaming in a visited system based on registration information the wireless unit provides to the visited system, the system comprising:

20 A. a mobile switching center of the visited system (MSC-V) operative to receive the registration information and in response to route a registration message to an international gateway;

B. the international gateway operative to receive the registration message, and in response, to create a new registration message including an identification of the MSC-V,  
25 the identification being other than a point code for the MSC-V, and to route the new registration message to a home mobile switching center (MSC-H) in the home system of the wireless unit; and

C. the MSC-H operative to receive the new registration message,  
whereby the home system is provided with the information about the  
30 wireless unit including the identification of the MSC-V serving the wireless unit.

17. The system of Claim 13, wherein the MSC-V comprises a first MSC-V;

wherein the wireless unit moves to an area served by a second MSC-V;

wherein the international gateway is operative to receive second  
5 registration information from the second MSC-V, to make a determination that an  
authorization period assigned to the wireless unit for provision of the communication  
services to the wireless unit is in effect, and to send a validation to the second MSC-V;  
and

wherein the second MSC-V in response to receipt of the validation provides  
10 the wireless unit with the communication services in the area served by the second MSC-  
V.

18. In a communications environment wherein a wireless unit has a registration  
with a first visited mobile switching center (MSC), and wherein the wireless unit moves  
15 to an area served by a second visited MSC, a method for validating the wireless unit with  
the second visited MSC without checking with a home system of the wireless unit,  
comprising:

A. receiving at the second visited MSC registration information from the wireless  
unit;

20 B. in response to receiving the registration information causing the second visited  
MSC to route the registration information to an international gateway;

C. in response to receiving the registration information, causing the international  
gateway to make a determination that an authorization period assigned to the wireless unit  
for provision of communication services is in effect; and

25 D. in response to the determination, causing the international gateway to send a  
validation with respect to the wireless unit to the second visited MSC.

19. The method of Claim 18 further comprising:

30 E. upon receiving the validation, causing the second visited MSC to consider the  
wireless unit as validated.

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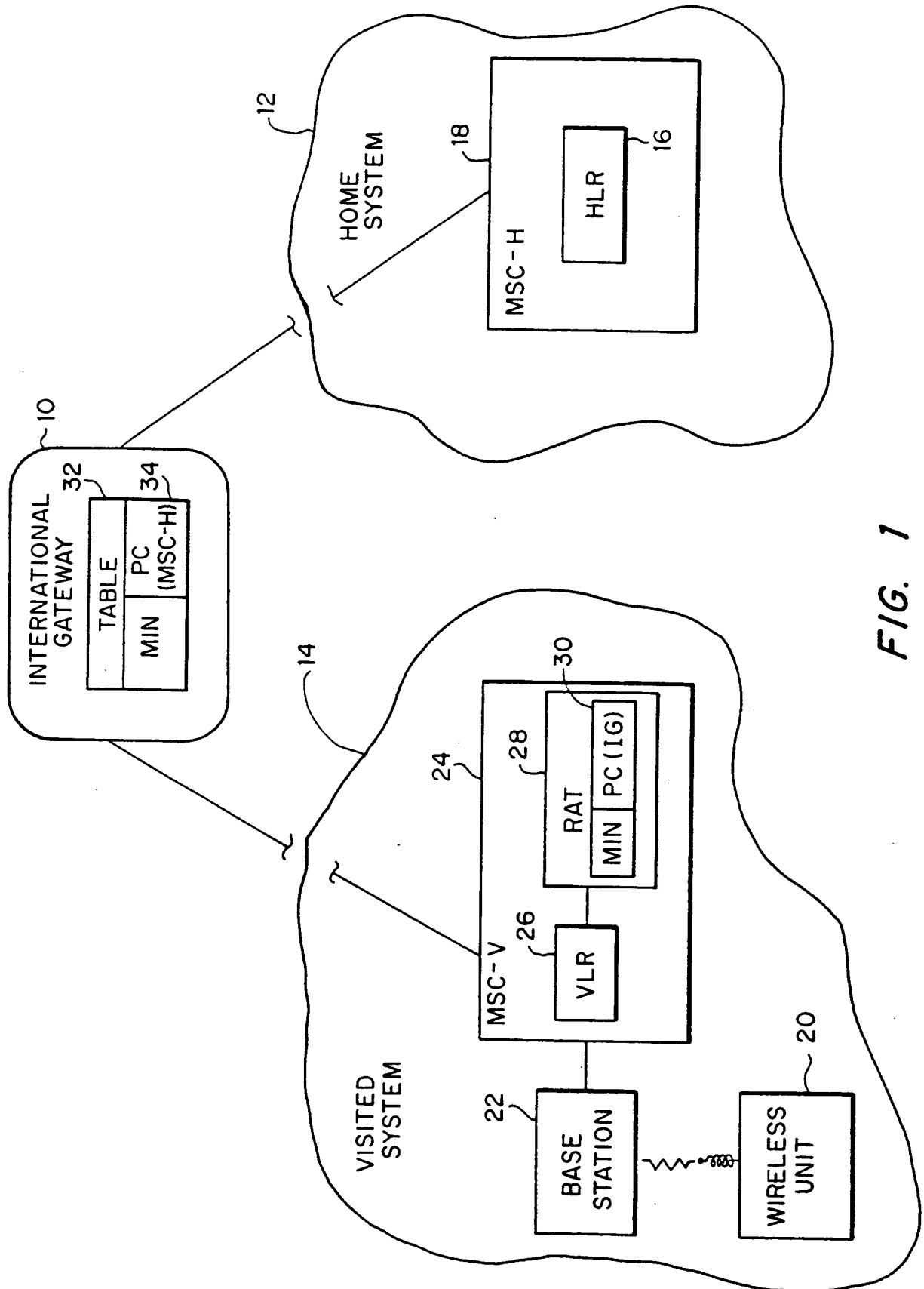
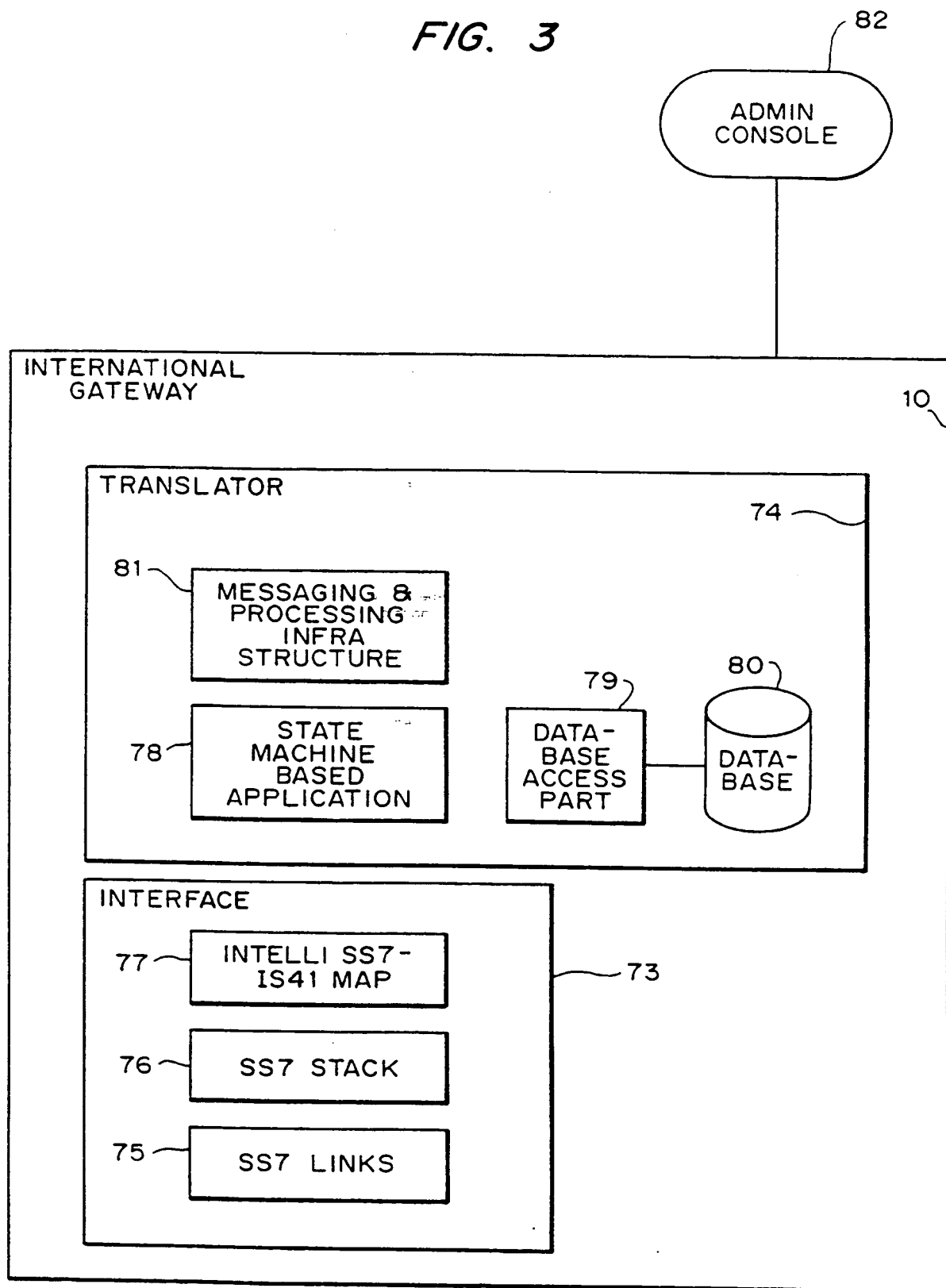
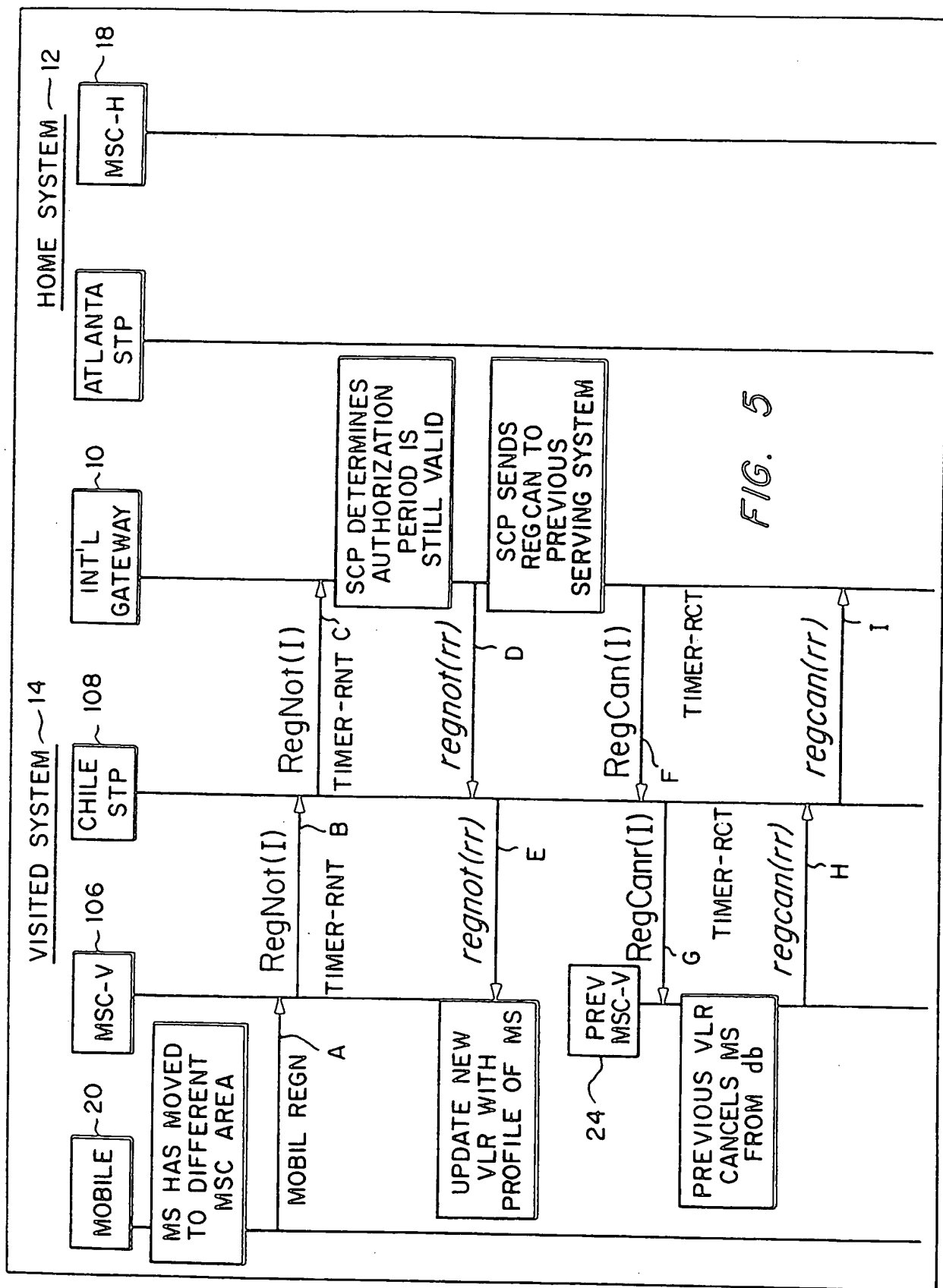


FIG. 1

FIG. 3





# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/17218

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>WO 98 02011 A (AMERICAN PCS COMMUNICATIONS  LL) 15 January 1998 (1998-01-15)  page 6, line 22 -page 7, line 22  page 8, line 15 - line 21  page 10, line 4 -page 11, line 7  page 14, line 28 -page 16, line 17  -----</p>	1,3,8,12